



Water Levels of the Great Lakes

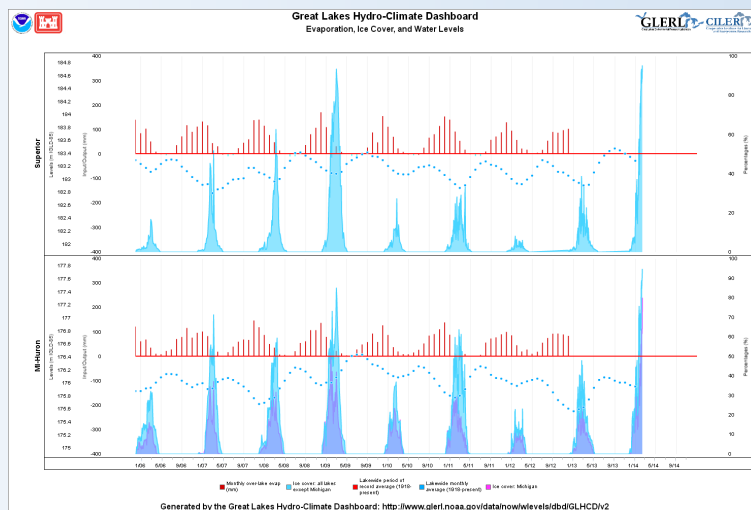
February 2014

The Great Lakes, their connecting waterways, and their watersheds, comprise the largest surface freshwater system on the planet. The monthly, seasonal, and annual surface water elevations of the lakes fluctuate in response to a variety of factors. This brochure provides a brief overview of historical Great Lakes water level patterns and current water levels, as well as the research NOAA conducts through its Great Lakes Environmental Research Laboratory (GLERL) on seasonal water level forecasts.

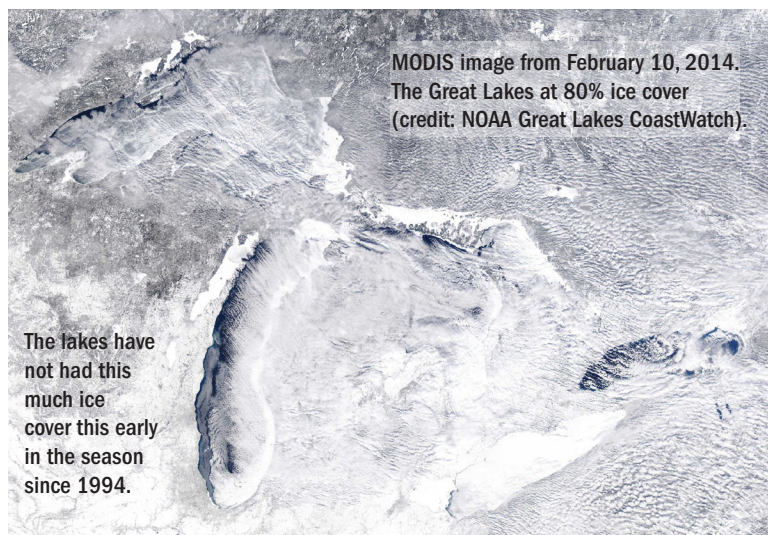
Water levels, ice, and evaporation - how are they related?

When a severe winter brings extensive ice cover to the Great Lakes, questions arise about potential impacts on water levels. Does more ice cover lead to higher water levels because of decreased evaporation? This is not a simple question, due to the complex relationship between these factors and the massive surface areas over which they interact in the Great Lakes. NOAA-GLERL has been exploring these relationships for over 30 years through development of model simulations and analysis of observations of ice cover, over-lake evaporation, surface water temperature, and lake levels.

The figure at right reveals the strong seasonality of evaporation and ice cover. Note that the majority of evaporation on each lake occurs before the onset of ice. It is likely that this winter's severe ice cover may impact the thermal structure of the Great Lakes through 2014, potentially causing lower water temperatures that will lead to less evaporation during the fall of 2014. Combined with this year's above average snow pack and increased spring runoff, it is not entirely unlikely that water levels could begin to approach their long-term average on Lakes Michigan and Huron in the next year. NOAA-GLERL is currently working with a team of regional research scientists to improve the monitoring networks that collect over-lake evaporation data, and to use that data to improve understanding of these important relationships.



This plot compares monthly average water levels (blue dots) with modeled evaporation (orange vertical bars) and observed ice cover (teal [Superior, Huron] and purple [Michigan] vertical bars) for Lakes Superior and Michigan-Huron for 2006 to present. Examine this data yourself at: <http://www.glerl.noaa.gov/data/now/wlevels/dbd/GLHCDV2>



How are water levels predicted?

Forecasts of Great Lakes monthly-average water levels are typically based on computer simulation models. One example is the Great Lakes Advanced Hydrologic Prediction System (AHPS), developed by NOAA-GLERL, which combines historical meteorological data with a series of mathematical models and climate forecasts from NOAA's Climate prediction Center to simulate multiple variables. The most important variables are overlake precipitation, overlake evaporation, and rainfall-induced runoff. The sum of these variables ("net" supply of water to the basin) is routed through the lakes and connecting channels using models that reflect flow patterns and regulation rules in order to produce a band of probability-based future water levels.

FOR MORE INFORMATION

<http://www.glerl.noaa.gov/data/now/wlevels/levels.html>

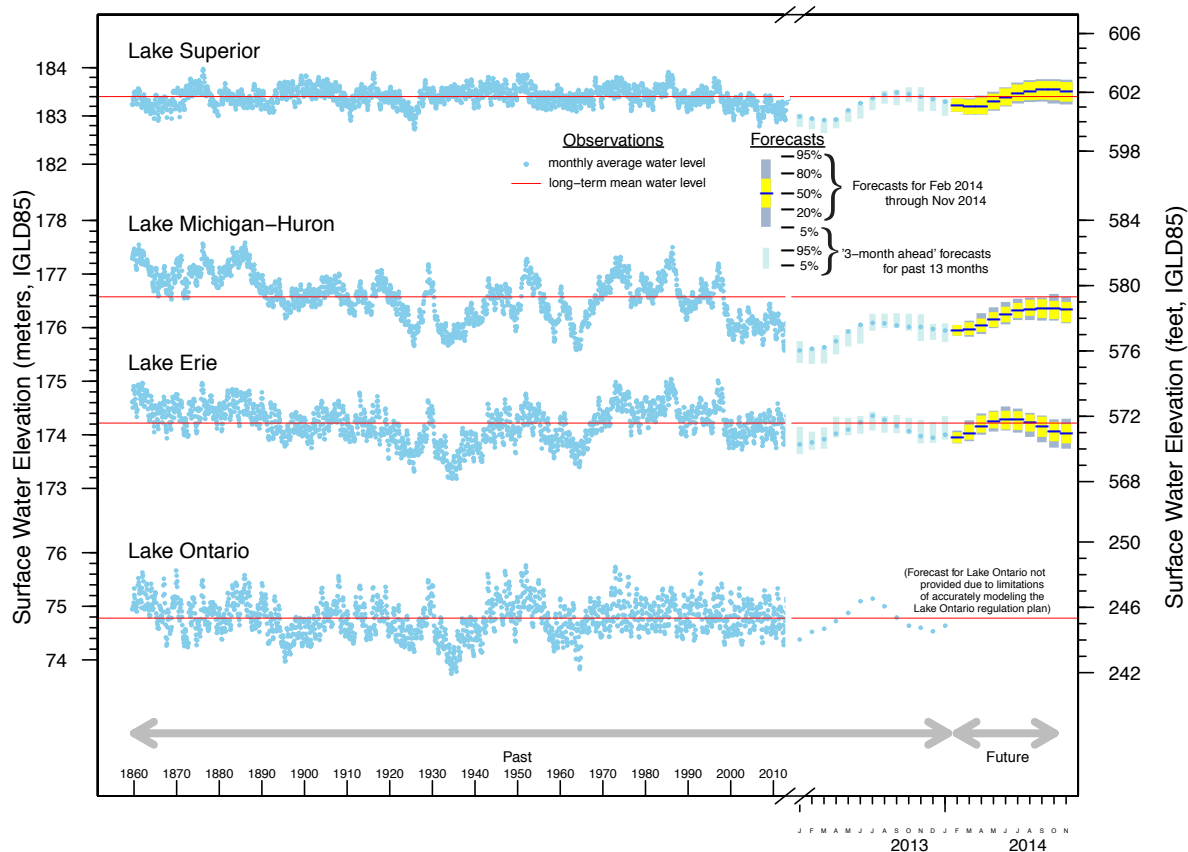
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The Current Outlook for Great Lakes levels

The research-oriented forecast generated by NOAA-GLERL's AHPS on February 10, 2014 indicates that the water levels of Lake Michigan and Huron will be significantly higher this summer than during the summer of 2013. Lake Superior may be slightly higher than last year, and Lake Erie water levels will be similar to 2013. The uncertainty expressed in the forecast shown here is based on observed weather patterns and Great Lakes water levels from 1948 to present, along with NOAA Climate Prediction Center's regional forecasts. The 5 and 95% bands are expected to contain the observed water level 90% of the time. The NOAA-GLERL AHPS forecasts are used by the U.S. Army Corps of Engineers and Environment Canada as part of their operational water level forecasting systems (<http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/waterlevelforecasts/monthlybulletinofgreatlakeswaterlevels>).



GREAT LAKES SYSTEM PROFILE

The Great Lakes, their respective watersheds and waterways, and the ocean are all connected. Within the Great Lakes system, water flows from Lake Superior via the St. Marys River into Lake Huron. Lakes Michigan and Huron are joined at the Straits of Mackinac, which allows these two lakes to act as one hydrologic system. The upper lakes meet the lower lakes at the Huron-Erie corridor, which is comprised of the St. Clair River, Lake St. Clair, and the Detroit River. Lake Erie flows over Niagara Falls and into Lake Ontario before flowing through the St. Lawrence River into the Atlantic Ocean.

What is IGLD85?

IGLD85 refers to the International Great Lakes Datum, an elevation benchmark (reference point) against which all water level gauging stations in the Great Lakes are compared. This reference point was last established in 1992. IGLD requires updating about every 30 years because the land surface around the Great Lakes is constantly changing in elevation due to the 'bounce back' of the earth's crust following the retreat of the glaciers during the last ice age (also referred to as isostatic rebound).

